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Comparable study on different coloured sticky traps for catching of onion thrips, *Thrips tabaci* Lindeman

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Abstract
Preference of insects towards specific colour is a much known phenomenon. Most often yellow coloured sticky traps are used to trap aphids and whiteflies. Onion growers in particular face miserable problem of thrips infestation during winter months. There is virtually no effective alternative to tackle the menacing effects of thrips in onion crop. To understand the preference of colour by the onion thrips a study was conducted using different coloured traps (blue, white, yellow and fluorescent green). The blue coloured sticky trap attracted more number of thrips over the crop growth period than white, yellow and fluorescent green sticky traps. Blue coloured sticky trap also attracted comparatively less number of beneficial insects and can be used for relative estimate of *T. tabaci* population and also for monitoring and mass trapping as a component of IPM programme.

Keywords: Coloured sticky traps, mass trapping, monitoring, *Thrips tabaci*

1. Introduction
Onion (*Allium cepa* L.) is an important export oriented vegetable among the cultivated *Allium* in India. Its acreage was 11.73 lakh ha with an annual production of 189.27 lakh tons in India during 2014-15. The productivity of onion in India was 16.13 tons/ha during 2014-15 [1]. In West Bengal the area under onion was 25.31 thousand hectare with an annual production of 380.15 thousand tons and productivity of 15.02 tons/ha [1].
Onions and related allium crops are subjected to attack by a variety of arthropod and nematode pests and diseases that can reduce crop yield both in terms of quantity and quality. Among insect pests, onion thrips, *Thrips tabaci* Lind. (Thysanoptera: Thripidae) is the most serious one inflicting significant yield reduction. *T. tabaci* has pandemic distribution and is considered as a pest of vegetable crops. They are more predominant in tropical and subtropical areas of the world on field and greenhouse grown crops. It is a key insect pest in most onion growing regions of the world. They are slender insects, may reach upto 2 mm length in adult stage. Immature and adult thrips feed with a punch-and-suck method that removes leaf chlorophyll causing white to silvery patches and streaks. They can damage the crop indirectly through transmission of certain lethal plant viruses. Thrips can infest onion at all the phonological stages of crop growth but their population increases from bulb initiation and remain high till bulb development and maturity. Thrips is a regular and potential pest of onion and cause considerable losses as high as 90% in quality and yield [2-4].
It is difficult to control this pest with insecticides because of its small size and cryptic habits. Farmers are extensively using different types of insecticides for controlling the pest. However, a repeated application of chemicals is not a desirable practice, as this could lead to undesirable resistance problems. To avoid further resistance in this pest, different non chemical methods need to be evaluated. Thus sticky traps, a cultural control method can be used as a component of integrated pest management. Determination of colour preference of crop pests may help develop pest traps using such attractive colors, thus providing opportunities for pest control by integrating specific colors into crop management methods. This helps either to reduce or avoid the use of synthetic pesticides and hence helping to avoid the buildup of pesticide residues in the environment and food. Coloured sticky traps could be a simple and low cost method for determining the relative abundance of insects. It is needed for the determination of colour preference of thrips to get maximum catches of the insect. Hence, the study was conducted to determine the preference of *T. tabaci* on various coloured sticky traps.

2. Materials and Methods

2.1 Experimental site and time

An experiment was conducted to compare the specificity of *T. tabaci* towards different coloured sticky traps at the C-Block farm of BCKV, Kalyani, Nadia, West Bengal (India) during *Rabi* 2015-16.

2.2 Experimental procedure

The onion (variety Sukhsagar) seedlings were raised in the nursery and thirty days old seedling were transplanted on 20.11.2015 in raised flat beds with a spacing of 15×15 cm. The size of the plot was $4m^2$. Four coloured sticky trap viz. blue, yellow, white and fluorescent green were tested to determine the preference of onion thrips. The trial was planned in Randomized Block Design with five replications. No pesticides were applied to the nursery and main-field crop.

2.3 Preparation of coloured sticky traps

Sticky cards were prepared by laminating the different colour papers. Each card was fixed on the card board which was attached to the iron rod and they were placed at the canopy level. Petroleum jelly was uniformly applied on the surface of each colour card. The petroleum jelly on the card was replaced at weekly interval after recording thrips population. Each card consists of 8×12 square grids measuring 1 square inch per grid.

2.4 Observations

Thrips which were stuck on coloured sticky traps were counted from ten square grids using hand held magnifying lens. Observation on the beneficial insects (coccinellid predators, honey bees, hoverfly and parasitic wasps) that stuck on the traps was also counted. Observations were taken at seven days interval commencing from 7 DAI (days after installation) till 35 DAI.

2.5 Statistical analysis

The data were subjected to work out the analysis of variance (ANOVA). The least significant differences (LSD) were estimated and the mean values of thrips and beneficial insect population were compared at ($P \leq 0.05$) [5].

3. Results and Discussion

At 7 days after installation of trap (DAI), significantly maximum number of thrips (4.42/sq. inch area) was recorded on blue trap followed by yellow and white trap (Table 1). The minimum catch was observed on fluorescent green trap being, 1.52/sq. inch area (Table 1). Likewise, at 14 DAI, the blue trap had maximum catches of onion thrips followed by white colour (Table 1). Minimum catch was observed on yellow and fluorescent green colour. Similar trend was observed at 21, 28 and 35 DAI. Performance of coloured traps with regard to the catching of *T. tabaci* was in the order of blue>white>yellow>fluorescent green. Regarding catch of beneficial insects, no significant differences were observed among colour sticky traps (Table 2-5). However, the maximum catch of coccinellid predators, honey bee, hoverfly and parasitic wasp was recorded with yellow sticky trap (Table 2-5). Minimum number of coccinellid predators was attracted to fluorescent green (0.86/trap) followed by blue sticky trap (0.87/trap). The blue colour trap attracts less number of honey bee, hover fly and parasitic wasp being, 0.81, 0.83 and 0.79 per trap, respectively (Table 2-5). Therefore, the blue sticky trap exhibited its suitability over other coloured sticky traps and can be used for trapping thrips as an important component of cultural method of thrips management in onion crop.

Table 1: Mean no. of thrips per square inch area on different coloured sticky traps

Treatments	No. of thrips per square inch area of trap				
	7 DAI	14 DAI	21 DAI	28 DAI	35 DAI
T_1: Blue trap	4.42	9.74	5.34	7.32	8.34
T_2: Yellow trap	1.84	2.82	2.54	2.20	3.42
T_3: White trap	2.14	7.92	3.92	4.72	5.32
T_4: Fluorescent green trap	1.52	2.30	1.90	2.90	4.30
S.Em (±)	0.32	0.55	0.29	0.40	0.33
LSD (0.05)	0.98	1.71	0.89	1.25	1.01

Note: DAI-Days after installation of trap

Table 2: Mean no. of coccinellid predators on different coloured sticky traps

Treatments	No. of coccinellid predators per trap					
	7 DAI	14 DAI	21 DAI	28 DAI	35 DAI	Mean
T_1: Blue trap	0.81 (0.2)*	0.91 (0.4)	0.91 (0.4)	0.81 (0.2)	0.91 (0.4)	0.87 (0.29)
T_2: Yellow trap	0.99 (0.6)	1.09 (0.8)	0.91 (0.4)	0.99 (0.6)	0.99 (0.6)	0.99 (0.57)
T_3: White trap	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.20)
T_4: Fluorescent green trap	0.91 (0.4)	0.81 (0.2)	0.91 (0.4)	0.91 (0.4)	0.81 (0.2)	0.86 (0.29)
S.Em (±)	0.14	0.14	0.12	0.13	0.13	-
LSD (0.05)	NS	NS	NS	NS	NS	-

Note: Data shown in the table are (x+0.5) square root transformed
* Data in parentheses indicate original values

Table 3: Mean no. of honey bees on different coloured sticky traps

Treatments	No. of honey bees per trap					
	7 DAI	14 DAI	21 DAI	28 DAI	35 DAI	Mean
T_1: Blue trap	0.81 (0.2)*	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.20)
T_2: Yellow trap	0.91 (0.4)	0.99 (0.6)	0.91 (0.4)	0.99 (0.6)	0.91 (0.4)	0.95 (0.46)
T_3: White trap	0.99 (0.6)	0.91 (0.4)	1.02 (0.8)	0.81 (0.2)	0.99 (0.6)	0.93 (0.41)
T_4: Fluorescent green trap	0.81 (0.2)	0.91 (0.4)	0.81 (0.2)	0.91 (0.4)	0.91 (0.4)	0.88 (0.29)
S.Em (±)	0.14	0.15	0.12	0.15	0.12	-
LSD (0.05)	NS	NS	NS	NS	NS	-

Table 4: Mean no. of hover fly on different coloured sticky trap

Treatment	No. of hover fly per trap					
	7 DAI	14 DAI	21 DAI	28 DAI	35 DAI	Mean
T_1: Blue trap	0.81 (0.2)*	0.91 (0.4)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.83 (0.22)
T_2: Yellow trap	0.91 (0.4)	1.02 (0.6)	1.09 (0.8)	1.09 (0.8)	0.91 (0.4)	1.02 (0.55)
T_3: White trap	0.81 (0.2)	0.81 (0.2)	0.91 (0.4)	0.91 (0.4)	0.81 (0.2)	0.86 (0.25)
T_4: Fluorescent green trap	0.81 (0.2)	1.02 (0.6)	0.91 (0.4)	0.99 (0.6)	0.91 (0.4)	0.96 (0.38)
S.Em (±)	0.12	0.12	0.14	0.15	0.13	-
LSD (0.05)	NS	NS	NS	NS	NS	-

Table 5: Mean no. of parasitic wasp on different coloured sticky traps

Treatment	No. of parasitic wasp per trap					
	7DAI	14DAI	21DAI	28DAI	35DAI	Mean
T_1: Blue trap	0.81 (0.2)*	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.71 (0.0)	0.79 (0.20)
T_2: Yellow trap	0.91 (0.4)	1.09 (0.8)	0.99 (0.6)	1.19 (1.0)	1.01 (0.6)	1.03 (0.62)
T_3: White trap	0.91 (0.4)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.81 (0.2)	0.83 (0.22)
T_4: Fluorescent green trap	0.91 (0.4)	0.91 (0.4)	1.02 (0.6)	0.99 (0.6)	0.91 (0.4)	0.95 (0.46)
S.Em(±)	0.12	0.11	0.14	0.14	0.11	-
LSD (0.05)	NS	NS	NS	NS	NS	-

Note: Data shown in the table are (x+0.5) square root transformed
* Data in parentheses indicate original values

Generally yellow traps are particularly used for catching coleopteran, hemipteran, hymenopteran and thysanopteran insects [6, 7]. Yellow colour trap was also reported to be effective in capturing parasitic hymenoptera [8]. In the present study, authors have also recorded the maximum catch of coccinellid predators, honey bee, hoverfly and parasitic wasp in yellow sticky trap. Mass trapping of beneficial or non targeted insects by sticky traps may have negative effects, such as reducing their numbers, thus leading to an increase in pest population [9]. Blue and green coloured trap were observed to be less attractive to pollinating hoverfly and honey bees [10]. This statement is also at par with present study where blue colour trap attracted less number of honey bee, hover fly and parasitic wasp. The highest attraction to thrips, *Scirtothrips dorsalis* was observed in okra on yellow colour trap followed by green colour [11]. Masatoshi *et al*., 2009 also reported the superiority of yellowish green trap over green and yellow trap for catching yellow tea thrips [12]. However, Broadsgaard (1993) indicated that thrips were attracted to blue as well as to white colour [13]. Blue and white have been considered as the most preferred colours for several species of thrips, including *T. tabaci*. Blue traps caught significantly more thrips than the white ones [14, 15] which are similar with the present findings. Blue and white colours were reported to be more effective in trapping the thrips, *Ceratothripoides claratris* followed by purple in tomato [16]. The blue colour attracted highest number of *S. dorsalis* adults followed by yellow and pink colour. Colour cards can also be used for mass trapping and monitoring of insects in horticultural crop ecosystems [17].

Since thrips are very cryptic in nature and were difficult to trace the population to decide upon initiation of control measure, the specific colour trap can suitably be used to monitor their population and thereby help the farmers to protect the crop at the early stage of thrips infestation. The focus was mainly directed towards choosing the specific colours for trapping the onion thrips.

4. Conclusion

Blue coloured traps were found more effective in trapping *T. tabaci* as compared to yellow, white and fluorescent green trap. Use of blue coloured sticky traps may not be solely able to restrict the buildup of thrips population during the entire crop growing period. However, they can be integrated with other components of IPM program where detection and monitoring of thrips population is an integral part to decide upon commencement of pesticide application.

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